Health Consultation

Evaluation of Indoor Air Sampling Results (July 16-17, 2002) at the Washington Traffic Safety Commission Offices

TMC Cleaners (a.k.a. Olympia Drycleaners site) Olympia, Thurston County, Washington

EPA FACILITY ID: WAH000017277

September 18, 2003

Prepared by

The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Washington State Department of Health

Foreword

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This health consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of this health consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on specific health issues so that DOH can respond quickly to requests from concerned residents or agencies for health information on hazardous substances. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health. The findings in this report are relevant to conditions at the site during the time of this health consultation, and should not necessarily be relied upon if site conditions or land use changes in the future.

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Glossary

Acute	Occurring over a short period of time. An acute exposure is one which lasts for less than 2 weeks.
Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Aquifer	An underground formation composed of materials such as sand, soil, or gravel that can store and/or supply groundwater to wells and springs.
Cancer Risk Evaluation Guide (CREG)	The concentration of a chemical in air, soil or water that is expected to cause no more than one excess cancer in a million persons exposed over a lifetime. The CREG is a *comparison value* used to select contaminants of potential health concern and is based on the *cancer slope factor* (CSF).
Cancer Slope Factor	A number assigned to a cancer causing chemical that is used to estimate it's ability to cause cancer in humans.
Carcinogen	Any substance that can cause or contribute to the production of cancer.
Chronic	A long period of time. A chronic exposure is one which lasts for a year or longer.
Comparison value	A concentration of a chemical in soil, air or water that, if exceeded, requires further evaluation as a contaminant of potential health concern. The terms comparison value and screening level are often used synonymously.

Contaminant	Any chemical that exists in the environment or living organisms that is not normally found there.
Dose	A dose is the amount of a substance that gets into the body through ingestion, skin absorption or inhalation. It is calculated per kilogram of body weight per day.
Environmental Media Evaluation Guide (EMEG)	A concentration in air, soil, or water below which adverse non-cancer health effects are not expected to occur. The EMEG is a *comparison value* used to select contaminants of potential health concern and is based on ATSDR's *minimal risk level* (MRL).
Epidemiology	The study of the occurrence and causes of health effects in human populations. An epidemiological study often compares two groups of people who are alike except for one factor, such as exposure to a chemical or the presence of a health effect. The investigators try to determine if any factor (i.e., age, sex, occupation, economic status) is associated with the health effect.
Exposure	Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). Exposure may be short-term (acute) or long-term (chronic).
Groundwater	Water found underground that fills pores between materials such as sand, soil, or gravel. In aquifers, groundwater often occurs in quantities where it can be used for drinking water, irrigation, and other purposes.
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.

Indeterminate public health hazard	Sites for which no conclusions about public health hazard can be made because data are lacking.
Lowest Observed Adverse Effect Level (LOAEL)	LOAELs have been classified into "less serious" or "serious" effects. In dose-response experiments, the lowest exposure level at which there are statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.
Media	Soil, water, air, plants, animals, or any other part of the environment that can contain contaminants.
Minimal Risk Level (MRL)	An amount of chemical that gets into the body (i.e., dose) below which health effects are not expected. MRLs are derived by ATSDR for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.
Model Toxics Control Act (MTCA)	The hazardous waste cleanup law for Washington State.
Monitoring wells	Special wells drilled at locations on or off a hazardous waste site so water can be sampled at selected depths and studied to determine the movement of groundwater and the amount, distribution, and type of contaminant.
No apparent public health hazard	Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.
No Observed Adverse Effect Level (NOAEL)	The dose of a chemical at which there were no statistically or biologically significant increases in frequency or severity of adverse effects seen between the exposed population and its appropriate control. Effects may be observed at this dose but were judged not to be "adverse."

Oral Reference Dose (RfD)	An amount of chemical ingested into the body (i.e., dose) below which health effects are not expected. RfDs are published by EPA.
Organic	Compounds composed of carbon, including materials such as solvents, oils, and pesticides which are not easily dissolved in water.
Parts per billion (ppb)/Parts per million (ppm)	Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene (TCE) in 1 million ounces of water is 1 ppm. 1 ounce of TCE in 1 billion ounces of water is 1 ppb. If one drop of TCE is mixed in a competition size swimming pool, the water will contain about 1 ppb of TCE.
Plume	An area of contaminants in a specific media such as groundwater.
Reference Dose Media Evaluation Guide (RMEG)	A concentration in air, soil, or water below which adverse non-cancer health effects are not expected to occur. The EMEG is a *comparison value* used to select contaminants of potential health concern and is based on EPA's oral reference dose (RfD).
U.S. Environmental Protection Agency (EPA)	Established in 1970 to bring together parts of various government agencies involved with the control of pollution.
Volatile organic compound (VOC)	An organic (carbon-containing) compound that evaporates (volatilizes) easily at room temperature. A significant number of the VOCs are commonly used as solvents.

Background and Statement of Issues

The Washington State Department of Health (DOH), in cooperation with the Thurston County Public Health and Social Services Department (TCHD) conducted an exposure investigation to evaluate whether contaminants present in area soil and groundwater have moved, as a gas, up through the ground and into the indoor air of a building currently occupied by the Washington Traffic Safety Commission (WTSC). Some WTSC staff have expressed health concerns relating to indoor air quality. The building occupied by the WTSC is located at 1000 South Cherry Street in Olympia, Washington. DOH prepares health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

Environmental testing since 1995 has revealed the presence of numerous contaminants in area soil and groundwater in the vicinity of the Howard's Drycleaners (Howard's) site, and the WTSC. Howard's was formerly known as Olympia Drycleaners. Chemicals detected in groundwater include gasoline, heavy oil, tetrachloroethylene (PCE), trichloroethylene (TCE), 1,2-dichloroethylene (1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), vinyl chloride, toluene, and xylenes, while chemicals detected in the soil have included gasoline, heavy oil, PCE, TCE, DCE, and toluene (Table A1).[1,2] The likely source of the PCE is Howard's Drycleaners, an adjacent, active drycleaning business. The presence of TCE is consistent with its use as a drycleaning agent at the site. Some of the other chemicals detected are degradation products of PCE. The Howard's site is the focus of an investigation and cleanup effort supervised by the Washington State Department of Ecology (Ecology). This health consultation evaluates the results of indoor air samples collected at several locations in the WTSC building. DOH prepared a previous health consultation that evaluated contaminants present in soil, as well as the potential impact of site contaminants on artesian wells in the downtown Olympia area.[3]

Site history

The Howard's Drycleaners site is located at 606 E. Union Avenue, at the intersection of Cherry Street, in a residential and commercial area of downtown Olympia (Figure 1). Howard's and previous drycleaning businesses have operated at the site for the past 30 years. An initial investigation of the drycleaning facility in early May 1995 revealed the chemicals noted above in soil and groundwater.

In late May 1995, additional soil and groundwater samples were collected at depths ranging from two to six feet and analyzed for volatile organic compounds (VOCs) and petroleum products (TPH). An artesian well located west of the facility, reportedly used for drinking by employees, was also tested for VOCs and TPH in June 1995.[1]

More recent soil and groundwater testing conducted in late 2002 and early 2003 revealed similar concentrations of these chemicals.[2] Appendix A, Table A1 lists the maximum levels of contaminants measured in soil and groundwater at the site since testing began in 1995. As noted above, site soil and groundwater contaminants from the 1995 testing were evaluated in a

previous health consultation prepared by DOH in June 1999. The 1999 health consultation concluded that contaminants in the soil did not represent a health hazard to exposed, or potentially exposed persons, and that the artesian wells evaluated posed either no apparent public health hazard, or an indeterminate health hazard due to insufficient data.[3]

July 2002 indoor air sampling

The potential for VOCs in groundwater and soil to migrate upwards, as a gas, into overlying structures has prompted health and environmental regulatory agencies to evaluate this pathway more closely. Since high concentrations of VOCs have been measured in shallow groundwater in the immediate vicinity of the building occupied by the WTSC, an exposure investigation was conducted in the summer of 2002 to evaluate whether these VOCs may be entering this building at levels of health concern. The samples were collected using 6-liter Summa canisters with preset flow control devices that allowed time-weighted samples to be collected over a 24-hour period (from July 16-17, 2002). The samples were collected from four locations inside the building; the reception desk, a room in the north end of the building, an employee office at the south end of the building, and in the basement, underneath the north end of the building (Figures 2 through 7). Atmospheric Analysis & Consulting, Inc. analyzed the samples for VOCs using EPA Method TO-15.[4]

Sampling results

PCE, TCE, methylene chloride, and benzene were detected above their health comparison values in one or more locations tested. The concentrations and locations of these chemicals, and their health comparison values, are provided in Table A2 and A4, respectively. Although benzene was detected above its health comparison value in the four locations tested, the levels were low, and consistent with background levels of this chemical commonly present in urban indoor and ambient air (Table A4). As a result, benzene will not be discussed further in the health consultation.

A number of other VOCs were also found at low levels in indoor air.[4] Many of these VOCs were expected, since they have many common sources, including cleaning supplies, office equipment, nail polish, paint, and gasoline, among others. These other VOCs were either below health comparison values, or at background levels expected for these chemicals, and will not be discussed further in the health consultation.

Background

Background is defined here as the amount of PCE and TCE expected to be present in air without any known contribution from a particular source. The background levels cited in this health consultation were obtained from various indoor air studies conducted throughout urban areas of the U.S. Sources of background levels of PCE, TCE, and methylene chloride can include household products, recently dry-cleaned clothes, solvents, paints, etc.

Upon initial evaluation of the data, DOH informed the Director of the WTSC that no immediate health hazard existed, and that DOH

would conduct a more thorough evaluation to determine whether any additional actions are necessary to ensure that the health of WTSC staff is protected.[5]

Discussion

Environmental sampling data were screened using ATSDR, U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology) health-based criteria (comparison values). Contaminant concentrations below comparison values are unlikely to pose a health threat, and were not further evaluated. Contaminant concentrations exceeding comparison values do not necessarily pose a health threat, but were further evaluated to determine whether they are at levels which could result in adverse human health effects.

Soil and groundwater at the site is contaminated with PCE, PCE degradation products, and petroleum hydrocarbons.[1, 2] As noted previously, indoor air samples collected from the adjacent building occupied by the WTSC revealed the presence of several VOCs at levels exceeding health comparison values in one or more locations tested.[4] The potential public hazard posed by these chemicals is evaluated below.

Tetrachloroethylene (PCE)

PCE is a manufactured compound widely used for drycleaning fabrics and as a metal degreaser. It is also used as an intermediate in the manufacturing of other products. It evaporates easily into the air, and has a sharp, sweet odor at high concentrations.[6]

The highest concentration of tetrachloroethylene (31 µg/m^3) was detected in an office at the south end of the WTSC building. Lower levels (at or near 5 µg/m^3 indoor air median background levels) were detected in the other three locations tested (Table A2).

Noncancer effects

To evaluate possible noncancer effects from exposure to the chemicals of concern detected in indoor air, the levels were compared to their respective noncancer comparison value [EPA inhalation reference concentration (RfC) or ATSDR chronic minimal risk level (MRL)].

The MRL for PCE is based upon neurological effects observed during a 10-year occupational study.[6]

EPA Reference Concentration (RfC) and ATSDR Chronic Minimal Risk Level (MRL)

Inhalation reference concentrations (RfCs) and chronic minimal risk levels (MRLs) are concentrations in air below which noncancer health effects are not expected. RfCs and MRLs are based upon 24-hour exposures.

All PCE detections were below the MRL, and are not expected to result in adverse noncancer health effects for exposed persons.

Cancer effects

Most of the evidence that suggests PCE can cause cancer comes from animal experiments using doses much higher than are estimated to result from exposure at this site. Although it has not been shown to cause cancer in people, the U.S. Department of Health and Human Services has determined that it may reasonably be anticipated to be a carcinogen. The International Agency for Research on Cancer (IARC) has determined that it is probably carcinogenic to humans, based on limited human evidence and sufficient evidence in animals. EPA is currently reassessing PCE toxicity, and has not adopted a final position on the weight-of-evidence classification.[7]

Although a number of human studies (primarily epidemiology studies of dry-cleaning workers) suggest the possibility of increased cancer incidences from exposure to PCE, particularly esophageal and bladder cancers, it has not been shown to definitively cause cancer in humans. Other cancers suspected of being associated with exposures to high levels of PCE (much higher than levels measured in the building occupied by the WTSC) include intestinal, pancreatic, lung, kidney, skin, colon, and lymphatic/hematopoietic cancer. Following inhalation exposure to high levels of PCE, mononuclear cell leukemia was observed in rats and hepatic tumors were observed in mice. However, because both mononuclear cell leukemia and hepatic tumors are common in rats and mice, respectively, the relevance of these tumors to humans is not clear.[8]

The EPA's National Center for Environmental Assessment (NCEA) provides an inhalation unit risk range that can be used to estimate cancer risk.[7] Using the geometric mean of the range, the estimated increased risk of developing cancer from continuous exposure to the highest detected concentration of PCE in indoor air is low; approximately four additional cancers in a population of one million persons exposed over a working lifetime. Estimated increased cancer risks are even lower for persons exposed to the lower levels detected in the other locations tested.

Trichloroethylene (TCE)

TCE is primarily used as a metal degreaser, particularly in the automotive and metals industries. It is also found in some household products, such as typewriter correction fluid, paint removers, adhesives, and spot removers.[9] The only detection of TCE in indoor air (3.6 $\mu g/m^3$) was in the office at the south end of the WTSC building. This level exceeded the 0.6 $\mu g/m^3$ indoor air median background level for TCE.

The NCEA is currently revising a human health risk assessment on TCE, which will present EPA's most current evaluation of the potential health risks from exposure to this chemical. The mechanistic information suggests some risk factors that may make some populations more sensitive, and that TCE could affect children and adults differently. EPA supported monographs on trichloroethylene health risks have been recently published and are being used to develop updated EPA health risk characterizations for trichloroethylene (Scott and Cogliano 2000).[10]

Noncancer effects

TCE exposure is associated with a number of health effects, including neurotoxicity, immunotoxicity, developmental toxicity, liver and kidney toxicity, and endocrine effects.[10] The RfC for TCE is based on critical effects on the central nervous system, liver, and endocrine system.[8]

The single TCE detection (3.6 $\mu g/m^3$) was below its noncancer comparison value, and is not expected to result in adverse noncancer health effects for exposed persons.

Cancer effects

Recent and extensive review of available data has led EPA to characterize TCE as "highly likely to produce cancer in humans." These findings are consistent with those of the International Agency on Research of Cancer (IARC, 1995) and the National Toxicology Program (NTP, 2000). This classification is based on sufficient evidence in animals and limited evidence in humans. The strongest evidence that TCE can cause cancer in humans comes from occupational studies that have found increases in lung, liver and kidney cancers in workers exposed over several years.[9]

In experimental rodent studies, high doses of TCE administered to mice resulted in tumors of the lungs, liver, and testes. Other possible cancers associated with exposure to high levels of TCE include cancer of the bladder, stomach, prostate, kidney, and pulmonary system. TCE cancer effects levels (CELs), which were derived from lowest observed adverse effects levels (LOAELs) in chronic-duration studies on rats and mice, ranged from 100,000 ppb to 600,000 ppb.[8, 9] The TCE level detected in indoor air was thousands of times lower than these LOAELs.

Although the data obtained from high-dose animal or worker exposure studies is not directly applicable to exposures at the WTSC business, theoretical cancer risk estimates can be made based on this data. In order to estimate the increased lifetime cancer risk for persons assumed to be chronically exposed to the detected level of TCE in indoor air, the current recommended EPA inhalation slope factor was used. Using this slope factor, the estimated increased cancer risk from TCE exposure is estimated to be low; approximately five additional cancers in a population of 100,000 persons exposed.

Methylene chloride

Methylene chloride is a colorless liquid that has a mild sweet odor, and evaporates easily. It is widely used as an industrial solvent and as a paint stripper. The chemical is commonly found in spray paints, automotive cleaners, and other household products including cleaning supplies, office equipment, nail polish, paint, and gasoline among others.[11] The highest concentrations of

methylene chloride were measured at the reception desk (82 µg/m^3) and in the basement (40 µg/m^3). Lower levels, at or near the 2.7 µg/m^3 background level for methylene chloride, were detected in the other two locations tested.

All methylene chloride detections were below its noncancer comparison value, and is not expected to result in adverse noncancer health effects.

Cancer effects

Methylene chloride is considered a B2 (probable human) carcinogen. The classification is based on inadequate human data and sufficient animal data.[8] In rodent studies, methylene chloride resulted in an increased incidence of hepatocellular neoplasms, alveolar/bronchiolar neoplasms, and an increased incidence of benign mammary tumors.[8, 11]

The estimated increased cancer risk, assuming chronic exposure to the highest concentration of methylene chloride measured, is low; approximately one additional cancer in a population of 100,000 persons exposed over a working lifetime.

Multiple chemical exposure

Estimated increased cancer risks from exposure to all of the chemicals of concern were evaluated for each of the locations tested (Appendix A, Table A3). Methylene chloride at the reception desk and TCE in the south office room accounted for most of the risk. As methylene chloride is not a chemical associated with the groundwater plume, the most likely source is from office products within the WTSC building. The source of TCE is uncertain, but could also be from localized office products, or as a result of volatilization from the contaminated groundwater plume.

Child Health Initiative

ATSDR recognizes that infants and children may be more vulnerable to exposures than adults when faced with contamination of air, water, soil, or food.[12] This vulnerability is a result of the following factors:

- Children are more likely to play outdoors and bring food into contaminated areas.
- Children are shorter and their breathing zone is closer to the ground, resulting in a greater likelihood to breathe dust, soil, and heavy vapors.
- Children are smaller and receive higher doses of chemical exposure per body weight.
- Children's developing body systems are more vulnerable to toxic exposures, especially during critical growth stages in which permanent damage may be incurred.

Laboratory animal studies involving high dose exposures to the chemicals of concern detected in indoor air in the WTSC building (PCE, TCE, and methylene chloride) have resulted in reproductive and/or developmental effects.[6, 9, 11] For example, studies of animals exposed *in utero* (via oral exposure of mothers) indicate that PCE can adversely influence the developing nervous system, but studies to examine possible associations between occupational exposure of humans to PCE and increased risks for birth defects in offspring or reproductive effects such as menstrual disorders and spontaneous abortions provide only suggestive evidence that these types of effects may occur in humans.[6]

Since direct or indirect exposures to infants and young children inside the WTSC building are expected to be infrequent, the risks are minimal. In addition, levels of PCE, TCE, and methylene chloride that produced developmental and reproductive effects in the relevant toxicity studies were much higher than the levels detected inside the building.[6, 9, 11]

Conclusions

1. High levels of some volatile organic compounds (VOCs) and petroleum-related chemicals (gasoline and heavy oil) have been detected in soil and groundwater in the immediate vicinity of Howard's Drycleaners and the WTSC building since testing began in 1995.

2. The Washington State Department of Health, in conjunction with Thurston County Environmental Health, conducted an exposure investigation to evaluate the potential for migration of these VOCs from the groundwater to indoor air in the building occupied by the WTSC. Numerous VOCs were detected in indoor air, but only three (PCE, TCE, and methylene chloride) exceeded ambient background levels and/or health comparison levels, and were further evaluated. Based on the available (albeit limited) information, the source of the detections in indoor air could be the groundwater plume, aboveground transport from Howard's, or a combination of the two.

3. The levels of chemicals detected in indoor air do not pose a noncancer health hazard, although a low increased cancer risk was estimated for persons assumed to be exposed over a working lifetime, to the maximum level of the detected chemicals. Some of this risk can be attributed to exposure to background levels of these chemicals commonly present in urban ambient and indoor air.

4. Estimated exposures and risks are based on the results of a single air sampling event, and therefore may not represent conditions during other times of the year. The health risks associated with levels of most of the chemicals detected in indoor air are low and similar to background. However, PCE, TCE, and methylene chloride levels were elevated in one or more locations tested, and should be further investigated. Because future levels of these chemicals is unknown, this site is an indeterminate public health hazard pending more indoor air sampling.

Recommendations/Action Plan

1. Because of the elevated (albeit isolated) VOC detections in indoor air and high levels of VOCs and petroleum products in area groundwater, follow-up indoor air sampling should be conducted to assure that VOC levels are not higher during a different season (i.e., winter). Air sampling should also be repeated in the WTSC building following any subsequent site remediation to re-evaluate indoor air VOC levels.

   DOH also recommends that the Washington State Department of Labor and Industries (L&I) inspect Howard's Drycleaners to assure PCE levels are not above levels of concern for employees there.

   < DOH will follow up with TCHD, L&I, and the current property owner(s) on this issue. If subsequent sampling is conducted, the results should be provided to DOH for evaluation.

2. Localized groundwater should be more thoroughly characterized to determine groundwater gradient and to evaluate whether it could be an ongoing source of PCE and TCE detected in indoor air.

   < The environmental consultant hired to investigate the site (Stemen Environmental, Inc.) has recommended that a licensed hydrogeologist evaluate current site information to determine the direction of groundwater flow.

   < Area drinking water supplies have also been investigated and evaluated. With the exception of some artesian wells previously evaluated, domestic water in this part of Olympia is currently supplied by the city.

3. Adequate ventilation should be maintained within the office/business work areas to promote dispersion and reduce the accumulation of chemical vapors.

   < DOH and TCHD will discuss this with the business owners/employees.

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Appendix A
Concentrations and risk levels in indoor air at and near the Howard's Drycleaners site, Olympia, Washington

Table A1. *Howard's Drycleaners/Washington State Traffic Safety Commission site: Maximum levels of contaminants detected in soil and groundwater (1995 - 2003)*

Contaminant	Soil	Groundwater
	Concentration (ppb)	Concentration (ug/l)
Tetrachloroethylene (PCE)	4,160	50,000
Trichloroethylene (TCE)	80	4,500
1,2-Dichloroethylene (1,2-DCE)	240	4,515 [a]
Vinyl chloride	ND	1,300
1,1,1-TCA	ND	100
Toluene	55	2.4
Xylenes	ND	2.3
TPH - Gasoline	29,000	28,800 [a]
TPH - Heavy Oil	20,000,000 (2%)	2,700,000

a = Value represents the average of two duplicate sample analyses.
ND = Not detected Ppb = parts per billion kg = kilogram l = liter

Table A2. *Washington State Traffic Safety Commission: Chemicals detected in indoor air exceeding health comparison values (units are in micrograms per cubic meter)*

Chemical	Location			
	Reception Desk	South office	Room at north end of building	Basement
methylene chloride	82	9.7	3.8	40
benzene	2.1	1.7	1.5	1.5
tetrachloroethylene	8.7	31	7.1	3.3
trichloroethylene	ND	3.6	ND	ND

Table A3. *Washington State Traffic Safety Commission:*

Increased cancer risk associated with chemicals detected in indoor air

Chemical	Location			
	Reception Desk	South office	Room at north end of building	Basement
methylene chloride	1 x 10-5	1 x 10-6	4 x 10-7	5 x 10-6
benzene	2 x 10-6	2 x 10-6	2 x 10-6	2 x 10-6
tetrachloroethylene	1 x 10-6	4 x 10-6	1 x 10-6	4 x 10-7
trichloroethylene	ND	5 x 10-5	ND	ND
Total increased cancer risk	**1.3 x 10-5**	**5.7 x 10-5**	**3.4 x 10-6**	**7.4 x 10-6**

Table A4. *Washington State Traffic Safety Commission: Chemical comparison values and background indoor air values (units are in micrograms per cubic meter)*

Chemical	Comparison value		Background Indoor Air Literature Values	Reference Number
	Cancer	Non-cancer		
methylene chloride	3	90	2.7 (outdoor median)	13
benzene	0.1	4	10 (indoor median)	13
tetrachloroethylene	1.8	NA	5 (indoor median)	13, 14
trichloroethylene	0.009	40	0.7 (indoor median)	13, 14

Appendix B: Figures

Certification

This Health Consultation was prepared by the Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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